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(54) **Stamped and formed connector receptacle contacts**

(57) Disclosed is an improved electric connector terminal of stamped-and- formed thin metal sheet including a pair of parallel contact arms having contact portions formed at their ends as to define a male pin terminal receptacle gap therebetween. The pair of contact arms extend in the form of "U" with their shearing planes facing each other, and each contact portion is formed by bending its inner edge perpendicular to the plane of the metal sheet.

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**Description**Background of the Invention

[0001] The present invention relates to an electric connector terminal structure and a method of making the same from an elongated piece of thin metal sheet.

Prior Art

[0002] U-shaped connector terminal blanks are stamped and formed of an elongated strip of thin metal sheet, and such U-shaped terminals are used to receive mating pin terminals in their pin receptacle gaps. The terminals are arranged in parallel and are integrally connected to a carrier strip. In the parallel-arrangement the terminals are oriented relative to an insulating connector housing with their U-shaped front ends directed to the terminal slots in the insulating connector housing. All the terminals are inserted into the terminal slots from the rear side of the insulating housing at the same time to complete an electric connector. One example of such a U-shaped terminal structure is shown in Fig.4 (see Japanese Patent Application Laid-Open No.7-169523 and Utility Model Application Laid-Open No.4-23065). As shown in the drawing, a pair of contact arms 91a and 91b of the terminal 90 face each other, and are integrally connected to a shank via a joint piece 92. The opposite contact arms 91a and 91b define a pin receptacle gap 93 therebetween, forming contact portions on the inner surfaces of the ends.

[0003] As shown in Fig.5, a series of terminal blanks 95 are stamped from an elongated thin metal sheet. These terminal blanks 95 are parallel at regular intervals P, and are integrally connected to a carrier strip 94. The joint piece 92 of each terminal blank 95 is bent to be perpendicular to the opposite contact arms 91a and 91b to provide a complete terminal 90.

[0004] With this arrangement, however, joint pieces 92 traverse the blank- to-blank space, and therefore, the interval at which terminal blanks are parallel-arranged cannot be reduced below a certain limit.

[0005] It is preferable that a set of parallel terminals are inserted into the terminal slots of a connector housing at the same time. Such simultaneous insertion of numerous terminals, however, is prevented if the slot-to-slot interval in the connector housing is smaller than the blank-to-blank interval of the terminals, and therefore, in such a case, terminals have to be removed from the carrier strip and are inserted individually into the terminal slots one after another to complete an electric connector.

[0006] Also, disadvantageously parallel terminal blanks at relatively large intervals will cause the increase of the wasted metal sheet and thus, the cost of terminals will also be increased.

Summary of the Invention

[0007] One object of the present invention is to provide electrical terminal structure which permits the blank-to-blank terminal interval to be reduced to a minimum.

[0008] Another object of the present invention is to provide a method of making such terminals efficiently.

[0009] To attain these objects an electric connector terminal of stamped-and- formed thin metal sheet includes a pair of parallel contact arms having contact portions which are formed at the ends of the opposite contact arms to define a pin receptacle gap therebetween, is improved according to the present invention in that the pair of parallel contact arms extend in the form of "U" with their shearing planes facing each other, each of said contact portions being formed by bending its inner edge substantially perpendicular to the plane of the metal sheet.

[0010] With this arrangement the blank-to-blank joint space as required in the conventional parallel-arrangement of terminal blanks can be reduced, so that the blank-to-blank space may be reduced to possible minimum. Also, advantageously the confronting contact portions are formed such that a mating male pin terminal is slidably accommodated in the pin receptacle gap establishing good electrical contact therebetween.

[0011] A method of stamping and forming a thin metal sheet into electric connector terminals, each comprising a pair of parallel-arranged contact arms having contact portions formed at their ends to define a male pin terminal receptacle gap, is improved according to the present invention in that it comprises the steps of

stamping an elongated piece of thin metal sheet to provide a series of paired-contact arms with their shearing planes facing each other; and bending the inner edges of the opposite contact arms of each pair substantially perpendicular to the plane of the metal sheet to form the contact portions.

[0012] Other objects and advantages of the present invention will be understood from the following description of a terminal structure according to one embodiment of the present invention, which is shown in accompanying drawings:

Brief Description of the Drawings

[0013]

Fig. 1 is a plane view of terminal blanks and finished terminals arranged in parallel and integrally connected to a carrier strip;  
Fig.2 is a side view of the finished terminal;  
Fig.3 is a front view of the finished terminal;  
Fig.4 is a perspective view of a conventional terminal

nal; and

Fig.5 is a plane view of conventional terminal blanks parallel-arranged and integrally connected to a carrier strip.

#### Description of Preferred Embodiments

[0014] Referring to Fig. 1, an elongated piece of thin metal sheet is stamped to provide a plurality of terminal blanks 3 arranged in parallel and integrally connected to a carrier strip 2. The terminal blanks 3 are formed into finished terminals 1. The finished terminals 1 are integrally connected to each other via a sub-carrier strip 5, and to the carrier strip 2 via support pieces 4. The finished terminals 1 can be separated from each other by cutting the opposite boundary lines 6 between the terminal 1 and the sub-carrier strip 5.

[0015] As seen from Fig. 1, each terminal 1 includes an engagement section 7 for engaging walls of a selected terminal slot in a dielectric housing (not shown), an "L" shaped portion 8 integrally connected to the front side of the engagement section 7 and a tail section 10 integrally connected to the rear side of the engagement section 7. The tail section 10 is a crank-like shank having a press-fit pin 11 formed at its end (see Fig.2).

[0016] As seen from Figs.1-3, each "L" shaped portion 8 includes a contact portion 9 having a pair of parallel contact arms 13 arranged in the form of "U" in the plane of the engagement section 7, each contact arm terminating in a contact portion 14. Specifically, the inner edge of the free end of each contact arm 13 is formed by bending it substantially perpendicular to the plane of the engagement section (in the direction from the front to rear side of the sheet of Fig.1). The contact arms 13 are then sized to define a pin-receptacle gap 15 between the opposite contact portions 14 which face each other.

[0017] The "L" shaped portion is then bent at substantially a right-angle to position the plane of the contact arms 13 perpendicular to the plane of the engagement section 7.

[0018] With this arrangement terminals 1 are arranged in parallel with the shearing planes 13a of their contact arms 13 facing each other, permitting the paired contact arms 13 and the arm joints 12 to be arranged at smaller intervals, thus permitting terminals 1 to be arranged in parallel at significantly reduced intervals P (see Fig. 1). Specifically the terminal-to-terminal interval in the parallel-arrangement of conventional terminals 90 shown in Fig.5 is 3 mm wide whereas the terminal-to-terminal interval in the parallel-arrangement of terminals 1 shown in Fig. 1 is 2 mm wide.

[0019] The reduced terminal-to-terminal interval enables a set of terminals 1 to be press-fit in the terminal slots of a connector housing at the same time while all terminals 1 remain integrally connected both to the carrier strip 2 and the sub-carrier strip 5.

[0020] Each engagement section 7 has projections 16 and 7 formed on its front and rear sides. The projections are engaged by the inner opposite side walls of each terminal slot (not shown) when the terminal 1 is press-fit therein. Specifically, the terminal 1 is inserted in the terminal slot until the front projections 16 have engaged the terminal slot, so that the terminal may be tentatively fixed. Then, the boundary lines 6 are cut to separate the terminal 1, and the terminal 1 is pushed in to the terminal slot until the rear projections 17 have engaged the terminal slot.

[0021] Alternatively, all terminals 1 are held with a terminal mounting tool, the terminals 1 are then separated by cutting the boundary lines 6 and the terminals are press-fit in the terminal slots of an insulating housing. By either method, all terminals may be inserted in the terminal slots of a housing at the same time, and accordingly connectors can be manufactured efficiently.

[0022] The contact portions 14 of the opposite contact arms 13 face each other with their formed surfaces directed towards each other to form the male pin terminal receptacle gap. This arrangement prevents a mating pin terminal from being damaged should the shearing surfaces 13a of the contact portions be used to form the pin receptacle gap.

#### Claims

1. An pin receiving electrical terminal stamped and formed from thin metal sheet comprising:

a terminal engaging section, a pair of substantially parallel, spaced apart contact arms extending from said engaging portion, the sheared edges of said contact arms and said engagement portion forming a "U" shaped member, each contact arm having a contact portion formed at its respective distal end, said contact portions defining a gap to slidably receive and electrically engage an inserted male pin terminal, wherein said contact portions are formed by bending a portion of the sheared edge of each contact arm substantially perpendicular to the plane of said engagement section.

2. A pin receiving terminal of claim 1, wherein said terminal engaging section has a tail section extending opposite from said contact arms having its distal end formed into a press-fit pin.
3. A method for making a metallic terminal including a pin-receiving contact portion, said method comprising the steps of:

stamping sheet metal stock to define at least one terminal blank including an engagement section, an "L" shaped portion extending from a

side of said engagement section, a tail section extending from the opposite side of said engagement section, a contact portion extending from said "L" shaped portion having a pair of spaced apart contact arms forming a "U" shaped member defining a gap there between, said free ends of said contact arms terminating in tabs extending into the gap defined by said contact arms,

bending said tabs substantially perpendicular to the plane of said engagement section to form a contact portion on each of said contact arms,

applying a force to said "U" shaped member to adjust said gap between said contact arms such that said formed contact portions of said arms are positioned to slidably receive and electrically engage an inserted male pin terminal.

4. The method of claim 3, wherein it further includes a step forming the distal end portion of said tail section into a press-fit pin.

5. The method of claim 4, wherein it further includes a step of bending said "L" shaped portion substantially perpendicular to the plane of said engagement section.

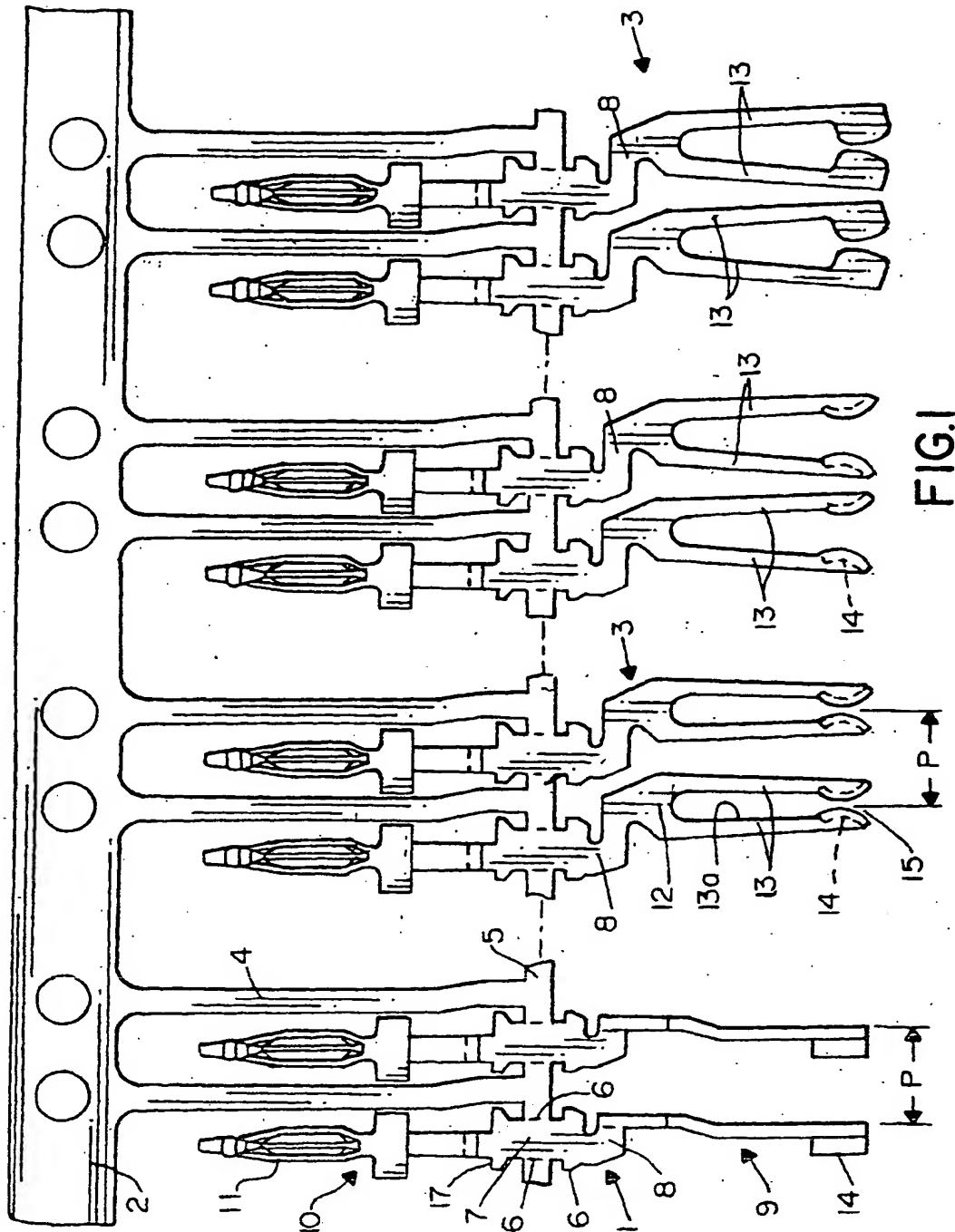


FIG. 1

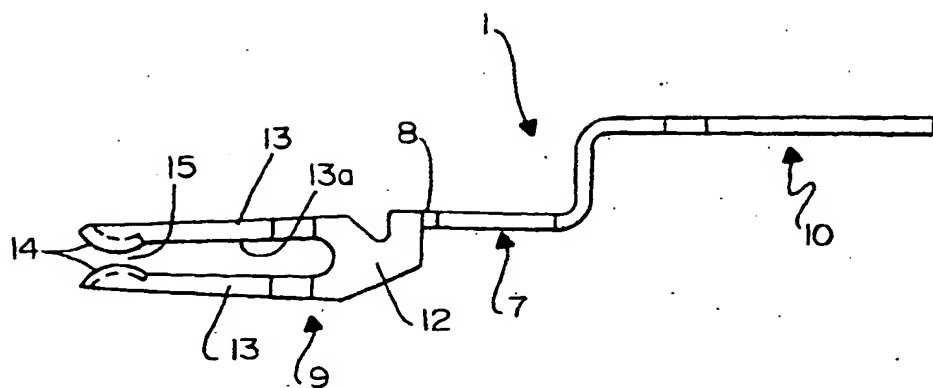


FIG. 2

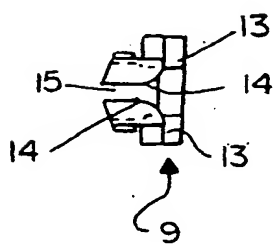
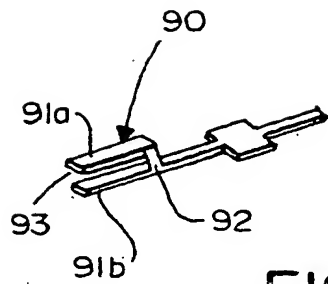


FIG. 3





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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 10 8341

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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search BERLIN		Date of completion of the search 28 July 2000	Examiner Stirn, J-P
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X: particularly relevant if taken alone  Y: particularly relevant if combined with another document of the same category  A: technological background  O: non-written disclosure  P: intermediate document</p> <p>T: theory or principle underlying the invention  E: earlier patent document, but published on, or after the filing date  D: document cited in the application  L: document cited for other reasons  &amp;: member of the same patent family, corresponding document</p>			

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**ANNEX TO THE EUROPEAN SEARCH REPORT  
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EP 00 10 8341

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
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28-07-2000

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